Florence-Carlton School

Public Water Supply

PWSID # MT0001054

SOURCE WATER DELINEATION AND ASSESSMENT REPORT

Date of Report: 11/08/2001

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ACKNOWLEDGMENTS

This Delineation and Assessment Report was completed by Jeff McCleary, contractor for Midwest Assistance Program (MAP) and Judy Sass, Rural Development Specialist with MAP.

Florence-Carlton School, Ravalli County

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INTRODUCTION

This report is intended to meet the technical requirements for the completion of the delineation and assessment report for the Florence-Carlton School as required by the Montana Source Water Protection Program and the federal Safe Drinking Water Act (SDWA).

The Montana Source Water Protection Program is intended to be a practical and cost-effective approach to protecting public drinking water supplies from contamination. A major component of the Montana Source Water Protection Program is termed delineation and assessment. The emphasis of this delineation and assessment report is identifying significant potential contaminant threats to public drinking water sources and providing the information needed to develop a source water protection plan for the Florence-Carlton School.

Delineation is a process whereby areas that contribute water to aquifers or surface waters used for drinking water, called source water protection areas, are identified on a map. Geologic and hydrologic conditions are evaluated in order to delineate source water protection areas. Assessment involves identifying locations or regions in source water protection areas where contaminants may be generated, stored, or transported and then determining the potential for contamination of drinking water by these sources.

Delineation and assessment is the foundation of source water protection plans, the mechanism the Florence-Carlton School can use to protect their drinking water source. Although voluntary, source water protection plans are the ultimate focus of source water delineation and assessment. This delineation and assessment report is written to encourage and facilitate the Florence-Carlton School operator and the community to complete a source water protection plan that meets their specific needs.

Limitations

This report was prepared to assess the threats to the Florence-Carlton School public water supply, and is based on published information and information obtained from local residents familiar with the community. The terms "drinking water supply" or "drinking water source" refer specifically to the source of the Florence-Carlton School public water supply and not any other public or private water supply. Also, not all potential or existing sources of groundwater or surface water contamination in the area of the Florence-Carlton School public water supply are identified. Only potential sources of contamination in areas that contribute water to its drinking water source are considered.

The terms "contaminant" and "toxin" are used in this report to refer to constituents for which maximum concentration levels (MCLs) have been specified under the national primary drinking water standards, and to certain constituents that do not have MCLs but are considered to be significant health threats.

CHAPTER 1

BACKGROUND

The Community

The Florence-Carlton School serves a population of 1076, students and faculty. The unincorporated community of Florence has an estimated population of 625. The school district obviously encompasses an area much larger than the community. Florence is predominantly a bedroom community with most residents working in Missoula or other areas. The only industrial activities are two (2) lumber mills located on the east side of Highway 93. The major transportation routes are Highway 93 (4-lane to Missoula; 2-lane south of Florence to Hamilton), old Highway 93 (2-lane between Florence and 2 mile north of the Missoula county line) and the Eastside Highway (2-lanes south to Hamilton).

The Florence-Carlton School is probably the largest water user in the community. A new car wash has been constructed in Florence. Their water consumption, at this time, would be a guess/estimate. The majority of the commercial establishments in the community are bars, restaurants, grocery store and offices. The Florence-Carlton School has several septic systems (considered large scale systems) and two (2) storm water infiltrator systems. Florence is not served by a community sewer. However, the Florence County Water and Sewer District has a completed a wastewater facility plan and is seeking funding for a community sewer system.

Geographic Setting

The community of Florence is located on the west side of the Bitterroot Valley in Ravalli County in Western Montana about 30 miles north of Hamilton and 20 miles south of Missoula. The Bitterroot River flows south to north approximately ½ mile east of the community. The elevation in Florence is about 3280 feet. The community is located on a terrace roughly 20-24- feet above the valley floor. Local vegetation consists of evergreens, grasses and shrubs.

The Florence-Carlton School is located on the northwest side of the community just south of Tie Chute Creek on the east side of Old Highway 93. Refer to the Vicinity Maps provided in Appendix A1 , A2, and A3.

Physiography and Climate

Florence is located at the base of the Bitterroot mountains on the west side of the Bitterroot River valley at an elevation of about 3280 feet above mean sea level (MSL). Natural vegetation consists of evergreens, grasses and shrubs. The project area is drained by Tie Chute and One Horse Creeks, tributaries to the Bitterroot River.

Climatic data for Stevensville, MT about 10 miles south of Florence are summarized in the following table. Mean annual precipitation at Stevensville is about12.5 inches, about 40% of which occurs as snowfall during the winter months.

Table 1. Period of Record Monthly Climate Summary - Stevensville, MT (247894).

Period of Record : 8/23/1911 to 4/30/1998

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average max. Temperature (F)	33	40	49	59	68	75	85	83	72	59	43	34	58.3
Average min. Temperature (F)	15	19	25	31	37	44	47	45	38	31	23	17	30.9
Average total Precipitation (in.)	1.1	0.9	0.8	0.8	1.5	1.6	0.9	0.9	1.1	0.9	1.1	1.1	12.49
Average total Snowfall (in.)	12	9.9	6.8	1.6	0.5	0	0	0	0	1	6.6	11	48.8
Average snow depth (in.)	3	2	1	0	0	0	0	0	0	0	1	2	1

McCurdy, G., 1998. Western Regional Climate Center, gmwrcc@dri.edu.

General Description of the Source Water

The geology of the Florence study area is characterized by a thick deposit of undifferentiated material generally made up of clay, sand, and gravel overlain by relatively young alluvial layers. These layers are made up of sand, gravel, and boulders and are roughly fifty feet thick based on descriptions of the well logs of wells drilled in the area. These formations appear to have water-bearing seams at various levels that interact with one another.

The Public Water Supply

The Florence-Carlton School's public water supply (PWS) system provides water for two (2) service connections with a current population of 1076 students and staff. For schools and staff, a textbook value (Metcalf & Eddy) of 20 gallons of water used per day per person is used here. School users 1080 (rounded up from 1076) x 20 gallons/day per user = 21,600 gal/day. The system is

classified as a Non-Community Non-Transient public water supply (PWS).The school owns five (5) wells. However only two (2) (wells #2 & #3) are used to provide potable water to the PWS. Well # 1 (located in the parking lot at the north end of the school) was disconnected from the system during a construction project several years ago. The other two (2) wells are used for irrigation and are not connected to the drinking water system.

Well #2 is located next to the southeast entry/exit door of the main building. According to the well log, this well is 42 feet deep. However, when the pump was replaced in 2000, it was sounded at a depth of 60 feet. This well is currently equipped with a 1 hp Jacuzzi pump. No information on the annular seal or grouting is available. However, the well is surrounded by a poured concrete floor under the eaves of the main building and should be considered safe from surficial contamination.

Well #3 is located in front of the east side of the boiler room. This well is 98 feet deep. It is currently equipped with a 2 hp Jacuzzi submersible pump. The well is grouted with concrete to a depth of 20 feet. The lithologic and construction logs for all five (5) wells are found in Appendix I.(Well #1, Well #2, Well #3, Well #4, and Well #5)

A storm drain (can be classified as a Class V Injection Well) which discharges below the ground surface is located approximately 50 feet from both wells. The school's septic drain fields are located approximately 300 yards down -gradient from both wells.

Both wells are manifolded inside the boiler room where they feed a 1200 gallon pressurized vertical storage tank, creating a single entry point. (The Sanitary Survey Diagram is found in Appendix B).

Water Quality

Sampling records of local public water supplies indicate that the ambient water quality generally meets standards set forth by the Safe Drinking Water Act. The water quality parameters shown on the table below reflect a water of generally good aesthetic quality and is generally representative of water quality in the area. The pH, calcium and conductivity suggest a corrosive nature which has been confirmed by the exceedance of action level for copper (1.33 mg/L) by the Community and Non-Transient Non-Community systems in the Florence area.

Bacteriological detections occurring in area public water supplies have been traced to human error and/or construction problems rather than contamination of the aquifer. Random bacteriological sampling of private wells in the area performed by Midwest Assistance Program in 1997 found no coliform positive samples. No enforcement action from Montana DEQ has been required for this PWS.

No chemical contamination has been documented. However, the "Groundwater Evaluation,Florence, MT" done in 1998 by Peter Norbeck and Katherine MacDonald states, " Analysyis of analytical data for nitrate and chloride in ground water at Florence

suggests that ground water is being degraded by septic tank effluent. No exceedances of drinking water standards were discovered in any of the test wells sampled to date. Additional development will likely result in nitrate concentrations exceeding the primary drinking water standard of 10 mg/L at some time in the future."(Norbeck and McDonald 1998)

The following table is representative of local ground water characteristics:

Table A Local Groundwater Characteristics Table

Parameter	Result
PH	6.5
Conductivity	119 umhos
Calcium	14 mg/L
Magnesium	2.5mg/L
Sodium	6.6mg/L
Iron	<.01
Manganese	<.005 mg/L
Sulfate	6.6 mg/L
Nitrate	1.98 mg/L

umhos = micro mhos
mg/L = milligrams per liter or parts per million

CHAPTER 2

DELINEATION

The source water protection area, the land area that contributes water to Florence-Carlton School is identified in this chapter. Three (3) management areas are identified within the source water protection area. These three (3) regions are the Control Zone, Inventory Region, and Recharge Region. The Control Zone, also known as the exclusion zone, is an area at least 100-foot radius around the well. The Inventory Region represents the zone of contribution of the well, which approximates a 3-year groundwater time-of-travel. Analytical equations describing ground water flow using estimates of pumping and aquifer characteristics and simple hydrogeologic mapping are used to calculate groundwater time-of-travel distance. The Recharge Region represents the entire portion of the aquifer that contributes water to the Florence-Carlton School water system.

Hydrogeologic Conditions

The geology of the Florence study area is characterized by thick deposits of Tertiary and Quaternary valley fill overlying Middle Proterozoic to Eocene bedrock. Several investigators have described the geology in this area including Ross (1952). McMurtry and others (1972), and Noble and others (1982) provides the most comprehensive description of the surficial geology surrounding the study area and is the basis for much of the summary below:

Bedrock is exposed at the higher elevations in the mountains that border the Bitterroot Valley. The Sapphire Mountains to the east are underlain by Proterozoic sedimentary rocks of the Belt Supergroup and to a lesser extent, Cretaceous intrusives and associated metamorphics. The Bitterroot Mountains to the west are underlain predominately by Cretaceous intrusive rocks and associated metamorphosed Proterozoic sedimentary rocks. Early Tertiary volcanics occur locally along the edge of the mountains (McMurtrey and others, 1972).

Unconsolidated to partially consolidated Tertiary deposits overlie bedrock throughout the valley and are best exposed on the broad terraces that flank the Bitterroot River. In the Florence area, these deposits are differentiated into those derived from the ancestral Bitterroot River and those formed as alluvial fans. The ancestral Bitterroot River deposits (Oligocene to Late Miocene) consist of well-sorted, well-rounded, well-stratified sand, pebbles, and cobbles with interbedded light tan clay and silt. A boulder dominated facies is present to the southwest of Florence and forms flat surfaces outlying bedrock at the higher elevations. The alluvial fan deposits (Pleistocene?) form gently sloping terraces perched 200 feet above the valley bottom. These deposits consist of poorly-sorted, moderately stratified, boulders and cobbles in a sandy silt matrix with abundant interbedded massive, micacaeous silt layers. The Tertiary alluvial fan deposits generally occur as interfluvial remnants separated by younger Quaternary fan and outwash terrace deposits.

The Quaternary deposits, including fan and outwash terrace deposits, flood-plain alluvium, older boulder fans, and minor colluvium mantle Tertiary sediments in most of the study area. The fan and outwash terrace deposits lie 5-25 feet above the valley floor and consist of well-rounded, unweathered cobbles and boulders in a matrix of sand and gravel. These deposits average 40 feet in thickness and are differentiated into older (Pleistocene) and younger (Late Pleistocene) units. The younger fans lie between and below and dissected remnants of older fans and underlie much of the study area, including the town of Florence. Older boulder fans (Pleistocene) deposited by debris flows are present southwest of Florence and consist of huge angular boulders up to 10 feet across in a poorly sorted matrix of gravel, sand, and silt. Minor colluvium and talus (Holocene) are present on the steeper slopes and consists of unconsolidated, unsorted, locally derived accumulations of angular boulders, cobbles, pebbles, sand, and silt.

East of Florence, the valley bottom is underlain by approximately 40 feet of Quaternary (Holocene) alluvial and flood-plain deposits. These deposits consist of well-rounded, well-sorted gravel and sand with minor silt and clay. Clast lithologies represent rock types of the entire drainage basin and were derived from reworked Tertiary and Pleistocene deposits. The Quaternary alluvium overlies approximately 2000 feet of Tertiary valley fill (Noble and others, 1982).

There is little consistency among the static water levels of the wells reviewed. Static water levels range from 10 to 40 feet deep, with the most uniformity occurring with two (2) wells finished at a depth of 60 and 63 feet having static water levels of 18 and 17 feet respectively. These conditions seem to be consistent with the nature of an unconfined aquifer that has multiple water water-bearing layers interacting with each other.

Ground water flow patterns based on measured water-level elevations in wells and on perennial stream elevations, are generally from east to west toward the Bitterroot River. This suggests that recharge occurs in topographically high areas, with discharge occurring to streams, wetlands and the Bitterroot River flood plain. Precise locales of ground-water discharge to streams are difficult to determine due to the complexity of conditions. Measurement of stream gain or loss gave a variety of results."

A preliminary GUDISW (groundwater under the direct influence of surface water) assessment was performed on both of these wells by Bill Engle of South Hills Environmental Consultants on 02/22/00. This preliminary study indicates that neither well should be considered under the direct influence of surface water.

It is anticipated that some south to north influence may occur during times of runoff in the spring. However this influence is more likely to be most noticeable in the valley floor and should not significantly influence the general west to east groundwater flow in the specific area of the study.

Groundwater flow direction for the predominately unconfined aquifer is assumed to follow the ground surface topographic relief. As such groundwater flow is depicted on the Groundwater Flow Direction Map found in Appendix D.

This aquifer can be classified as a moderately sensitive source water because the valley fill sediments are semi-consolidated and the alluvium is predominately unconfined to semi-confined. Aquifer susceptibility will be discussed further in Chapter 3 of this document.

Table 1. List of geologic or hydrogeologic investigations near the Florence area.

Title of Project	Period of Project	Area Covered	Project Purpose
Ground-water Evaluation Florence, Montana	July, 1996 - October, 1999	Sections 2,3,10,11,14 and 15, T.10 N, R 20 W	Study conducted with a view to community wastewater system
MBMG -No Title	February - July 1980 est.	Sections9,10,11,12,13,14,15, 16 T 10 N, R20W	Attempt to locate site for community water supply

Table 2. List of geologic or hydrogeologic maps available for the Florence area.

Title or Description	Date	Area Covered	Reference
Figure 7 Florence Area Geologic Map	October, 1999	Florence area, Range 20W	Ground-water Evaluation, Florence, MT by Peter Norbeck and Katherine McDonald

Conceptual Model and Assumptions

A review of the well logs of wells in the study area shows aquifer material consistent with that of an unconfined aquifer. The Ground-water Evaluation, Florence, Montana by Norbeck and McDonald includes a geologic map which shows the study area predominantly overlain with younger alluvial deposits, with older alluvial deposits in a small area along One Horse Creek, immediately west of Florence. This material is generally 40 to 50 feet in depth, with undifferentiated valley fill materials (sand, gravel, cobbles, silt and clay) lying beneath.

The aquifer is bounded on the north by Tie Chute Creek, on the south by One Horse Creek and on the west by the Bitterroot Mountains. According to Norbeck and McDonald "Ground water near Florence is recharged by direct infiltration of precipitation, and infiltration from streams, ditches and applied irrigation water. Ground water discharges to wells, springs, and streams and to the atmosphere by evaporation from free water bodies fed by ground water and by transpiration by plants.

Water-bearing material appears to be present from depths of 10 to 65 feet. There is probably hydraulic interaction throughout this formation.

Assumptions for this model are that little if any influence from the south-north flow of the valley floor aquifer is realized by the wells in the project area. However, due to the fact that the elevation of the Bitterroot River is 3195 feet and the lowest static water level among wells reviewed for the project is 3225 feet, this assumption seems reasonable.

It has also been assumed that available well log information is reasonably accurate. It cannot be known with certainty if all significant formations were recorded when the wells were drilled. Nor can it be accurately determined if the descriptions of the formations are consistent since one man's cobbles is another man's boulders. Nevertheless, the information gleaned from the well logs seems to provide information consistent with the characteristics of an unconfined aquifer.

Methods and Criteria

The source water protection Control Zone for the Florence-Carlton School PWS is the area within a 100 foot radius circle around each well. It was also determined that it would be best to inventory the entire delineated area. Therefore, the Recharge Region and Inventory Region are one and the same (A3 Site Map).

Well(s) Information

See Appendix I - Well Logs (Well #1, Well #2, Well #3, Well #4, Well #5)

Table 3. Source well information for Florence-Carlton School

Information	1. Well #1	• Well #2	• Well #3
PWS Source Code	002	003	004
Well Location (T, R, Sec)	10N 20W Sect 11	10N 20W Sect 11	10N 20W Sect 11
MBMG #	64028	64025	64023
DNRC Water Right #	Not Reported	Not Reported	Not Reported
Date Well was Completed	11/21/1972	9/6/1963	8/4/1982
Total Depth	52.70 feet	60 feet	98 feet
Perforated Interval	Open Bottom	24-26 feet	72-92 feet
Static Water Level	15 feet	12 feet	29 feet
Pumping Water Level	35 feet	20 feet	72 feet
Drawdown	20 feet	8 feet	43 feet
Test Pumping Rate	20 gpm	29 gpm	35 gpm
Specific Capacity	1 gpm/ft	3.625 gpm/ft	0.81 gpm/ft

Model Input

Table 4. Estimates of input parameters used to delineate the source water protection area**.**

Input Parameter	Range of Values and units	Values Used		
		Well #1*	**Well #2**	**Well #3**
PWS Source Code		002	003	004
Transmissivity	600 -6400	6240 ft^2/day	6240 ft^2/day	6240 ft^2/day
Thickness	0 -100 feet	37 feet	48 feet	69 feet
Hydraulic Conductivity	Table Values (Freeze & Cherry, 1979)	100 ft/day	100 ft/day	100 ft/day
Hydraulic Gradient	Topographical Gradient	0.01 ft./ft.	0.01 ft./ft.	0.01 ft./ft.
Flow Direction	Follows Topography	West to East	West to East	West to East
Effective Porosity	0.2	0.2	0.2	0.2
Pumping Rate	20 gpd per person	3850 ft^3/day	3850 ft^3/day	3850 ft^3/day
1-Year TOT*	1825 ft.	1825 ft.	1825 ft.	1825 ft.
3-Year TOT*	5475 ft.	5475 ft.	5475 ft.	5475 ft.

*Time of Travel

** Well #1 is included in this table since it is considered a viable source which may be used at some point in the future. It is not presently connected to the PWS water supply.

Transmissivity and hydraulic conductivity are based on lognormal means suggested in Norbeck and McDonald's Ground Water Evaluation, Florence, MT, page 18 for wells located in 10N 20W Section 11 (see references). Hydraulic gradient and flow directions are based on logical topographical information. Porosity is based on the standard estimated porosity of sand and gravel aquifers. The pumping rate is based on national averages of per user water use. The figures for these components are based on the best available information at the time of the assessment.

Delineation Results

See Florence-Carlton School Delineation Map -Appendix F1 and F2

Limiting Factors

Since specific data is not available on aquifer conditions throughout the entire delineation/Inventory Region, assumptions are made based on available information. For example, the porosity of the soils in the immediate area of the wells studied is probably not consistent throughout the delineation/Inventory Region, especially at higher elevations. However, locally known information should provide sufficient information for the conservative estimates presented. Estimates made regarding hydraulic conductivity, aquifer thickness, porosity, hydraulic gradient and hydraulic boundaries appear to be consistent with the characteristics of an unconfined aquifer as suggested by the conceptual model. Pumping rates are based on national averages of per person water use.

CHAPTER 3

INVENTORY

An inventory of potential sources of contamination was conducted for Florence-Carlton School PWS within the control and Inventory regions. Potential sources of all primary drinking water contaminants and Cryptosporidium were identified, however, only significant potential contaminant sources were selected for detailed inventory. The significant potential contaminants in the Florence-Carlton School Inventory Region are nitrate, pathogens, and fuels.

The inventory for Florence-Carlton School PWS focuses on all activities in the Control Zone, municipal and private facilities in the Inventory Region, and general land uses and large facilities in the Recharge Region.

Inventory Method

A windshield survey of the Control Zone and Inventory/Recharge zone was performed by Judy Sass (Midwest Assistance Program Staff Person and area resident), Margie O'Brien (member of the Florence Water and Sewer District Board) and Jeff McCleary (PWS O & M Contractor). Midwest Assistance Program is a co-sponsor of this Source Water Assessment and Delineation Project.

Available databases were searched to identify businesses and land uses that are potential sources of regulated contaminants in the Inventory Region. The following steps were followed:

Step 1: Urban and agricultural land uses were identified from the U.S. Geological Survey's Geographic Information Retrieval and Analysis System (http://nris.state.mt.us/gis/datalist.html). Sewered and unsewered residential land use were identified from boundaries of sewer coverage obtained from municipal wastewater utilities.

Step 2: EPA's Envirofacts System (http://www.epa.gov/enviro/) was queried to identify EPA regulated facilities located in the Inventory Region. This system accesses facilities listed in the following databases: Resource Conservation and Recovery Information System (RCRIS), Biennial Reporting System (BRS), Toxic Release Inventory (TRI), and Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS). The available reports were browsed for facility information including the Handler/Facility Classification to be used in assessing whether a facility should be classified as a significant potential contaminant source.

Step 3: The Permit Compliance System (PCS) was queried using Envirofacts (http://www.epa.gov/enviro/) to identify Concentrated Animal Feeding

Operations with MPDES permits. The water system operator or other local official familiar with the area included in the Inventory Region identified animal feeding operations that are not required to obtain a permit.

Step 4: Databases were queried to identify the following in the Inventory Region: Underground Storage Tanks (UST) (http://webdev.deq.mt.gov/UST/), hazardous waste contaminated sites (DEQ hazardous waste site cleanup bureau), landfills (http://nris.state.mt.us/gis/datalist.html), abandoned mines (http://nris.mt.gov/gis/datalist.html) and active mines including gravel pits. Any information on past releases and present compliance status was noted.

Step 5: A business phone directory was queried to identify businesses that generate, use, or store chemicals in the Inventory Region. Equipment manufacturing and/or repair facilities, printing or photographic shops, dry cleaners, farm chemical suppliers, and wholesale fuel suppliers were targeted by SIC code.

Step 6: Major road and rail transportation routes were identified throughout the Inventory Region (http://nris.mt.gov/gis/datalist.html).

Step 7. All land uses and facilities that generate, store, or use large quantities of hazardous materials were identified within the Recharge Region and identified on the Inventory Base Map. The Inventory Base Map is found in Appendix F2.

Potential contaminant sources are designated as significant if they fall into one of the following categories:

- Large quantity hazardous waste generators.
- Landfills.
- Underground storage tanks.
- Known groundwater contamination (including open or closed hazardous waste sites, state or federal Superfund sites, and UST leak sites).
- Underground injection wells.
- Major roads or rail transportation routes.
- Cultivated cropland greater than 20 % of the Inventory Region.
- Animal feeding operations.

- Wastewater treatment facilities, sludge handling sites, or land application areas.
- Septic systems.
- Sewer mains.
- Storm sewer outflows.
- Abandoned or active mines.

Inventory Results/Control Zone

The land in the Control Zones of Florence-Carlton School is owned by the school district. The primary land use of this property is for the school itself. The school's septic system is located outside of the Control Zone, down-gradient from the wells.

A drain that apparently discharges below ground surface is located within the Control Zone between the two (2) wells. This poses a significant potential for contamination since run-off water from the ground surface has unimpeded access to soils below ground surface in close proximity to the wells.

Chemical refuse from the school's chemistry lab is sent to the University of Montana in Missoula for disposal.

Some spray paint is used in the school's shop. This poses little, if any contamination hazard.

These potential contaminant sources located within the Control Zone are depicted on the Site Map found in Appendix F2. A completed Hazard Determination Worksheet evaluates the identified potential sources of contamination within the Control Zone. This worksheet is found in Appendix J1 and J2.

Inventory Results - Inventory Region/Recharge Region

For the purposes of the inventory and for the sake of convenience, the Inventory Region and Recharge Region were combined. The Inventory/Recharge Region can be logically divided into two (2) main areas - a light commercial area along Highway 93 and a rural-residential area, which dominates the study area. This combined Inventory Region and Recharge Region are depicted on the Base Map found in Appendix F1 and F2.

In the light commercial area there is a "bus barn" where school buses are maintained and parked. The oil from oil changes performed on the buses is disposed of in a used oil furnace.

A small auto body shop is located in the residential area where small amounts of paint and solvent are used and stored. These could be a potential source of VOCs. However, the owner is nearly retired and not much work of that sort is still carried on.

A taxidermy shop is located within the Inventory/Recharge Region. All hides are sent away to be tanned and no tanning is done on site at the taxidermy shop.

Another minor potential source is the dentist office, which may be a source of metals from dental amalgams.

There are also two (2) small beauty shops in the area.

Due to the size and scope of these businesses, they should probably not considered to be significant threats to groundwater, but nevertheless, worthy of mentioning in this study.

Significant sources of potential contaminants are the two (2) gas stations, which have underground storage tanks. These tanks represent a significant potential contaminant source for VOCs since there is a potential for large volume leaks or spills.

Another significant potential source of contamination are three (3) storm drains located at various points in the Inventory/Recharge Region. These drains have been identified as meeting the definition of Class V injection wells. They discharge unknown and unmonitored substances poured or washed from the ground surface to the soils below the ground surface with the potential of entering the aquifer with little impediment.

The potential contaminant sources listed above are shown on the Inventory Base Map found in Appendix F2.

The most prevalent potential source of contamination is the septic systems located throughout the community. These are sources for coliform, fecal coliform and nitrate contamination. As the community grows the increased volume of additional septic systems and discharge from them is almost certain to negatively impact the local groundwater.

A completed Hazard Determination Worksheet evaluates the identified potential sources of contamination in the Inventory/Recharge Region. This worksheet is found in Appendix J1 and J2.

Table 5. Significant potential contaminant sources for Florence-Carlton School.

Source	Contaminants	Description
UST	Gasoline	2 gas stations located south of the system on Hwy. 93 may pose a threat from spills or leaks
Septic Systems	Pathogens and Nitrates	In the absence of a community sewer system the system is surrounded by its own septic tanks and the septic tanks and drainfields of other residences and businesses.
Class V Injection Well	Various organic chemicals	At least three (3) Class V injection wells in the form of storm drains that discharge into the ground are located south of the system along highway 93.

Inventory Update

The certified operator will update the inventory every year. Changes in land uses or potential contaminant sources will be noted and additions made as needed. The complete inventory will be submitted to DEQ every five years to ensure re-certification of the source water delineation and assessment report.

Inventory Limitations

Since not every residence in the Inventory/Recharge Region could be investigated, there remains the possibility that some potential contaminants could be unaccounted for. No large volume producers of known contaminants were found or indicated in the investigation. No doubt some backyard oil changing and auto body work goes on. In a rural/residential setting such as this it is likely that some herbicides might be used, as well as some over-the-counter pesticides. However, no use of any significant volume of either of these was indicated by the inventory.

CHAPTER 4

SUSCEPTIBILITY ASSESSMENT

Susceptibility is the potential for a public water supply to draw water contaminated by inventoried sources at concentrations that would pose concern. Susceptibility is assessed in order to prioritize potential pollutant sources for management actions by local entities, in this case the Florence-Carlton School PWS.

The goal of Source Water Management is to protect the source water by 1) controlling activities in the Control Zone, 2) managing significant potential contaminant sources in the Inventory Region, and 3) ensuring that land use activities in the Recharge Region pose minimal threat to the source water. Management priorities in the Inventory Region are determined by ranking the significant potential contaminant sources identified in the previous chapter according to susceptibility. Alternative management approaches that could be pursued by the Florence-Carlton School PWS to reduce susceptibility are recommended.

Susceptibility is determined by considering the hazard rating for each potential contaminant source and the existence of barriers that decrease the likelihood that contaminated water will flow to Florence-Carlton School's wells. Some of the significant potential sources are listed on Table 5 found in Chapter 3 of this document. Hazard is rated by the proximity of a potential contaminant source to the wells. Susceptibility ratings are presented individually for each significant potential contaminant source and each associated contaminant. This ranking is described on Table 6 below.

Table 6. Relative susceptibility to specific contaminant sources as determined by hazard and the presence of barriers.

Presence Of Barriers	**Hazard Rating**		
	High	**Moderate**	**Low**
No Barriers	Very High Susceptibility	High Susceptibility	Moderate Susceptibility
One Barrier	High Susceptibility	Moderate Susceptibility	Low Susceptibility
Multiple Barriers	Moderate Susceptibility	Low Susceptibility	Very Low Susceptibility

Table 7. Susceptibility assessment for significant potential contaminant sources in the Control Zone and Inventory Region**.**

Source	Contaminant	Hazard	Hazard Rating	Barriers	Susceptibility	Management
UST (Underground Storage Tanks)	Gasoline	Leaking UST, spill	High	1-2	Moderate to High Susceptibility	Monitoring, spill prevention, spill response
Septic Systems	Pathogens and Nitrates	Infiltration Recharge	Moderate to High	None	High to Very High Susceptibility	Monitoring, with potential to joint community sewer and water system
Large Capacity Septic Systems	Pathogens and Nitrates	Infiltration Recharge	High	None	Very High Susceptibility	Monitoring, with potential to joint community sewer and water system
Class V Injection Wells	Various Organic Chemicals	Infiltration Recharge	High	None	Very High Susceptibility	Monitoring, with potential to joint community storm water system

The following items are the significant potential contaminants found in the Inventory/Recharge Region of the Florence-Carlton School. Susceptibility of contamination for these potential contaminants has been ranked quite conservatively and should not be used to make any regulatory decisions regarding the Florence-Carlton School public water supply without a more enhanced assessment. It is worthy of note that a community wastewater system with a well-documented and practiced management plan would no doubt greatly reduce the susceptibility of contamination from the potential contaminants listed. While the system currently monitors for contaminants which may result from these potential contaminant sources, monitoring only identifies the problem after the fact and does nothing towards preventing it.

UST (Underground Storage Tanks)

Hazard is ranked moderate for UST sites located within the Inventory/Recharge Region. The UST sites are located south of the public water supply approximately ¼ of a mile from the PWS wells along Highway 93. They are situated between the 1- and 3-years time-of-travel distance for groundwater. Compliance with DEQ leak detection and/or leak prevention requirements constitutes an engineered barrier for all UST sites. Consequently, susceptibility to this contaminants source is considered moderate to high.

Septic Systems

The portion of the Inventory Region where Florence-Carlton School is located has approximately 50 septic systems per square mile. The septic system for the School is located well outside of the 100-foot radius of the Control Zone and the drainfield is located down-gradient from the public water supply wells. It should be noted that the septic drainfield is located within Inventory Region and the estimated capture zone of the school's wells. The hazard rating for this contaminant threat is moderate to high. There are no barriers between the septic tanks and the wells and the tanks are considered to be within the capture zone of the wells. This situation gives the wells a high to very high susceptibility to this source of contamination.

Large Capacity Septic Systems

The community of Florence has no community wastewater system and the School itself has a large capacity septic system located down-gradient but within the Inventory Region of its water supply. The large capacity septic system poses a moderate to high hazard to the PWS. Susceptibility to contamination from this source is ranked high to very high since no barriers are present. While the drain field for this system is sufficiently down-gradient from the PWS source wells to provide adequate natural protection, failure of the septic tanks or pipes leading to the septic tanks may pose a very threat of contamination from this source, especially during times of ground water saturation when ground water flow may be diverted from its typical west-to-east flow pattern. A second large capacity septic system is associated with a trailer court located approximately 700 feet up-gradient of the School's water supply wells. This system is a significant potential source of contamination with no barriers present. Please refer to the Inventory Base Map in Appendix F2. A third large capacity septic system is located approximately 1000 feet down-gradient of the school's PWS wells. This system is outside the Inventory Region and the capture zone of the school wells. This system is associated with Glen's Cafe and is also located on the Inventory Base Map in Appendix F2. The natural gradient and the distance of this system from the school water supply wells may provide a reduction of the susceptibility. Susceptibility to contamination from these large capacity septic systems cannot be easily quantified, but these sources are ranked as posing a high hazard. Since no barriers are present, susceptibility of the PWS is considered to be very high. A community wastewater system would no doubt lessen the threat of potential contamination from these systems.

Storm Drainage System (also considered Class V Injection Wells)

Several storm drains are located in the Inventory Region because they drain surface run off directly into the aquifer. These storm drains create a hazard of contamination reaching the Florence-Carlton School public water supply wells since there are no barriers. One (1) of these drains is located within the Control Zone between the School's two (2) active wells and may be the possible source of bacteriological events the School's water supply has experienced in the past. The storm drainage system at the school and in several areas of Florence consist of simple collection pipes that concentrate runoff and allow infiltration directly into the subsurface. Therefore, the school's PWS is determined to have a very high susceptibility to this source of contamination. Changing this drain to discharge to a well-managed community wastewater system would significantly reduce susceptibility.

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Internet source of graphical and tabular information provided by Montana State Library - Natural Resource Information Service: http://nris.state.mt.us/mapper/

Internet source of tabular well information at the Montana Bureau of Mines and Geology Information Service:

http://mbmgsun.mtech.edu/ & http://mbmggwic.mtech.edu/